



# **FIO RTU FIO SOLAR**

**Remote Terminal Unit per FIO 2.0**

## **User manual**

<b>Edition</b> 0	<b>Revision</b> 1
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<b>Date</b> 09/10/2014
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**Index**

<b>1. Information</b>	<b>4</b>
1.1 <i>Index of revisions</i>	4
1.2 <i>Symbols</i>	4
1.2.1 Symbols in this manual	4
1.2.2 Symbols on the appliance	4
1.3 <i>Contacts</i>	4
1.4 <i>Product identification</i>	5
1.5 <i>Marking and identification</i>	5
1.5.1 Ex parameters table	7
1.6 <i>Safety requirements</i>	8
1.6.1 Electric safety	8
1.6.2 Installation Precautions	8
1.6.3 Fuses	8
1.6.4 Cables	8
1.6.5 Batteries	8
1.6.6 Internal temperatures	8
1.6.7 ESD precautions	8
<b>2. Product overview</b>	<b>9</b>
2.1 <i>Description</i>	9
2.2 <i>Apparatus layout</i>	10
<b>3. Installation</b>	<b>13</b>
3.1 <i>Mechanical</i>	13
3.1.1 Solar panel installation	14
3.2 <i>Electrical installation</i>	15
3.2.1 Terminal blocks	15
3.2.2 General information	17
3.2.3 Cable glands	18
3.2.4 Power supply	18
3.2.5 Data connections	18
3.3 <i>Cables</i>	19
3.3.1 Ex conformity	20
3.3.2 Maximum cable length	20
3.4 <i>Settings</i>	21
3.4.1 Serial communication isolator settings	21
3.4.2 Remote power supply settings	21
3.4.3 Digital signal isolator settings	21
3.4.4 24V Power supply settings	21
<b>4. Operation</b>	<b>22</b>
4.1 <i>Description</i>	22
4.2 <i>Led signaling</i>	22
4.2.1 RS485/RS232 repeater/isolator	22
4.2.2 Switching repeater/isolator	22
4.2.3 Remote PWS	22
4.2.4 Battery charger	22
4.2.5 PWS- DC/DC converter 24V	23
<b>5. Technical data</b>	<b>24</b>



5.1	<i>General</i>	24
5.2	<i>Power supply</i>	24
5.3	<i>Functional</i>	25
5.4	<i>Normative compliance</i>	25
<b>6.</b>	<b>Maintenance.....</b>	<b>26</b>
6.1	<i>Battery</i>	26
6.1.1	Battery life	26
6.1.2	Battery replacement	26
6.1.3	Fuse	26



## **1. Information**

### **1.1 Index of revisions**

Revision	Date	Reason of change
0.1	09/10/2014	First release

### **1.2 Symbols**

#### **1.2.1 Symbols in this manual**



Pay attention to instructions



Use precautions against electrostatic discharge

#### **1.2.2 Symbols on the appliance**



Pay attention to the indications regarding the Max limits admitted for the power supply and the input and output signals. Pay attention to the temperature of the terminals of the relay outputs and their connection cables.



Earth connection point.

### **1.3 Contacts**

The product is manufactured by



*Contacts for sales and support*

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[www.fiorentini.com](http://www.fiorentini.com)



## 1.4 Product identification

The products have the name FIO RTU and FIO SOLAR and several models are available according to the power and functionality installed.

Code	Description
AP0670T02M01R00	FIO2 RTU cabinet 115-230VAC +LF/HF+RS232/485
AP0670T02M02R00	FIO2 RTU cabinet 24V DC +LF/HF+RS232/485
AP0670T02M03R00	FIO2 Power Box 115-230VAC
AP0670T02M04R00	FIO2 RTU cabinet 115-230VAC +RS232/485
AP0670T02M05R00	FIO2 RTU cabinet 115-230VAC +LF/HF
AP0670T02M06R00	FIO2 RTU cabinet 24VDC +RS232/485
AP0670T02M07R00	FIO2 RTU cabinet 24VDC +LF/HF
AP0670T03M01R00	FIO2 Solar Power box (20W-12Ah)
AP0670T03M02R00	FIO2 Solar RTU cabinet (20W-12Ah) +LF/HF
AP0670T03M03R00	FIO2 Solar RTU cabinet (20W-12Ah) +RS232/485
AP0670T03M04R00	FIO2 Solar RTU cabinet (20W-12Ah) +LF/HF+RS232/485

### NOTE

Power Box	the device has only the remote power section
Cabinet	apparatus that also integrates the signal interfacing devices
LF/HF	apparatus that integrates an isolator for digital signal repeater
RS232/485	apparatus that integrates an isolator for the conversion from RS232 to RS485
20W – 12Ah	20W solar panel and 12Ah lead-acid battery

The "code" is not listed on the device's label

## 1.5 Marking and identification

On the front there is a label that contains the information to identify the individual apparatus, certifications and the main parameters.

- **Logo and address of the manufacturer**
- **Model Name** Apparatus name
- **Serial number** numeric code that uniquely identifies the single apparatus
- **CI** product configuration
- **Certifications**

### Model Name

FIO RTU 115-230VAC  
FIO RTU 24VDC  
FIO SOLAR

### Serial Number

YYASnnnn

YY two digits to indicate the year of manufacture  
AS apparatus type  
nnnn progressive number

### CI

Digital Output  
1 Digital output isolator installed  
0 Digital output isolator not installed

### Serial Interface

S2 RS485 to RS232 isolator converter installed  
0 Serial interface not installed

### Example

S/N 13AS0010 Year of manufacture 2013, apparatus type AS, progressive number: 0010  
CI DOS2 Digital output isolator: installed  
Serial interface isolator: Installed

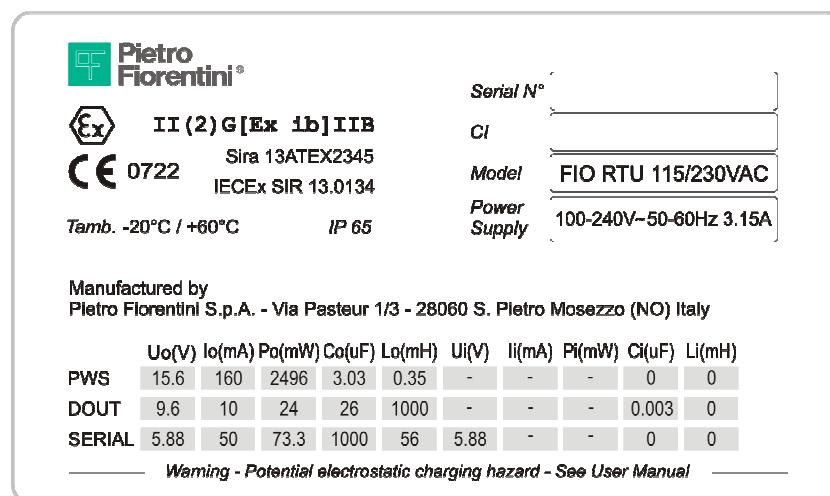


Fig. 1 - Apparatus identification label for FIO RTU 115-230V

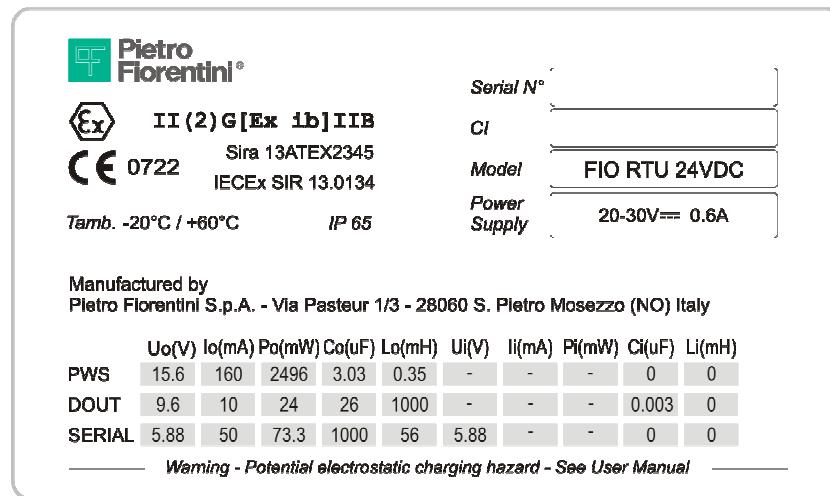


Fig. 2 - Apparatus identification label for FIO RTU 24VDC

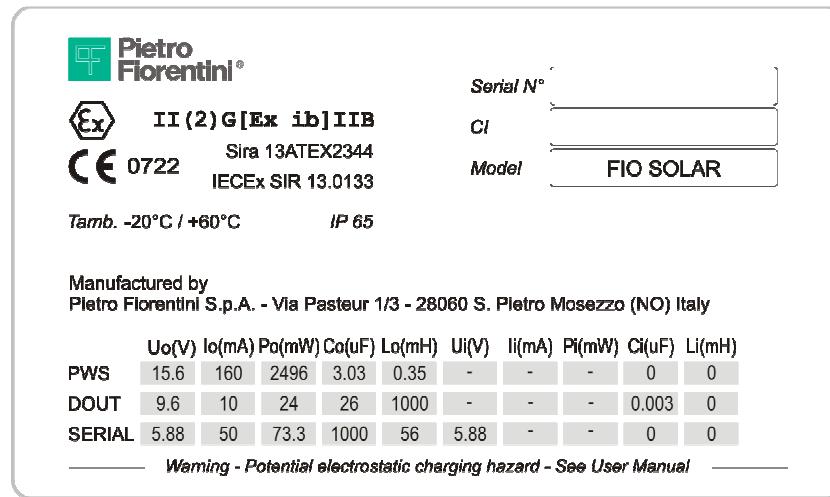


Fig. 3 - Apparatus identification label for FIO SOLAR



### 1.5.1 Ex parameters table

The table is the same for both products

	<b>Uo (V)</b>	<b>Io (mA)</b>	<b>Po (mW)</b>	<b>Co (uF)</b>	<b>Lo (mH)</b>	<b>Ui (V)</b>	<b>li (mA)</b>	<b>Pi (mW)</b>	<b>Ci (uF)</b>	<b>Li (mH)</b>
PWS	15.6	160	2496	3.03	0.35	-	-	-	0	0
DOUT	9.6	10	24	26	1000	-	-	-	0.003	0
SERIAL	5.88	50	73.3	1000	56	5.88	-	-	0	0

#### Description of the symbols and label data

**Sira 13ATEX2344 / 45**

Number of the certificate of conformity to ATEX standards

**IECEx Sira 13.0133/ 34**

Number of the certificate of conformity to IECEx standards

CE Logo

**0722**

ID of the notified body (IMQ)

Ex Logo

**II**

Apparatus group (II surface)

**(2) G**

Output IS category (2), Atmosphere type (G)

**[Ex ib]**

Type of protection – Associated apparatus

**IIB**

Gas group

**Tamb: -20°C / +60°C**

temperature field in which is guaranteed compliance with IS



## **1.6 Safety requirements**

### **1.6.1 Electric safety**

This apparatus can be powered at mains voltage 115-230VAC or 24VDC low-voltage. The installation and connection to the mains must be carried out by authorized installers.

A main switch or circuit breaker must be installed upstream of the device. Place the switch near the device and within the area of installation in an easily accessible position.

The earth connection is compulsory. Use a yellow/green cable of minimum section of 2.5 mm<sup>2</sup>, crimp on this a ring terminal with 4-5 mm internal diameter. Firmly attach the ground screw terminal of the device identified by the symbol  at the bottom of the container.

The ground wire must be connected to the earth of the installation site. Execute the ground connection before connecting the power supply.



#### **Security Panel for power supply terminals**

The Security Panel of the Terminal (RTU 115-230V) is an integral part of protection devices do not remove the security panel with mains voltage present.

### **1.6.2 Installation Precautions**

To prevent bits of wire or other material from reaching the interior of the apparatus, perform the termination and cable wiring before installing the apparatus.



#### **Ventilation grids of the internal devices**

Do not obstruct the grids of internal devices. Pay attention that no metallic fragment enters grids. If liquid enters into the openings, immediately disconnect the power supply, do not use the appliance and contact the manufacturer's technical support.



#### **Installation area**

FIO RTU / SOLAR are associated apparatus  
Install them in SAFE AREA

### **1.6.3 Fuses**

#### **Only for FIO SOLAR**

The apparatus contains one user-replaceable fuse only. In case of replacement, for the continuity of safety, replace with the same type as indicated in the technical specifications.

### **1.6.4 Cables**

This apparatus is certified ATEX/IECEX for installation in safe area. Use only the cables type indicated in the technical specification.

### **1.6.5 Batteries**

#### **Only for FIO SOLAR**

This device contains a lead-acid battery. The battery is installed on the bottom and blocked by a special support. The battery is replaceable by the user only with an identical model.

### **1.6.6 Internal temperatures**

Internal devices heat up during operation but no dangerous temperatures for the user are reached.

### **1.6.7 ESD precautions**

The internal circuit boards of the devices used within the FIO RTU/SOLAR (barriers/Insulators) can be damaged by electrostatic discharge that may be produced by the operator. The boards are not accessible; you should take precautions when accessing terminals for wiring.

- switch off the apparatus
- discharge your electrostatic charge by touching a metal surface that is connected to the ground
- If available use a wrist strap (connected to ground)

#### **WARNING**

**Failure to comply with the requirements described in this manual or use in an unspecified way, may affect the protections provided.**



## 2. Product overview

### 2.1 Description

FIO RTU (Five In One – Remote Terminal Unit) and FIO SOLAR (RTU solar power supply) are a series of devices suitable to connect Ex-i devices installed in hazardous area. In particular, FIO RTU and SOLAR are designed to connect to the controller named FIO 2.0.

FIO RTU e SOLAR must be installed in safe area as associated apparatus with compliance with directives 94/9 EC.

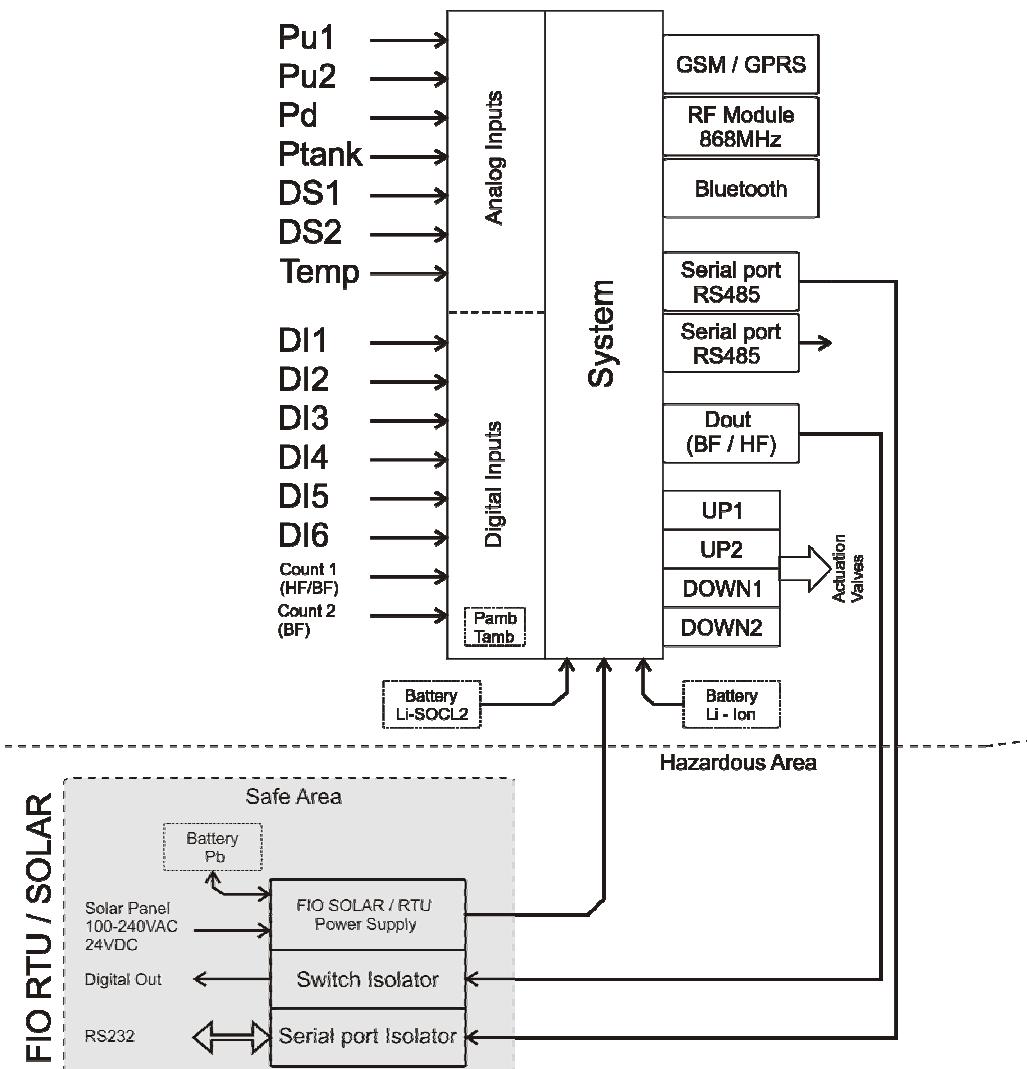


Fig. 4 - System architecture FIO 2.0 – FIO RTU/SOLAR

FIO RTU / SOLAR with reference to the model do the following functions:

- Remote power supply for FIO2
- Isolator serial converter from RS485 to RS232
- Isolator for the output digital signal from FIO2.0 from NAMUR to open collector



## 2.2 Apparatus layout



Use measures to prevent electrostatic discharges when accessing internal parts of the equipment

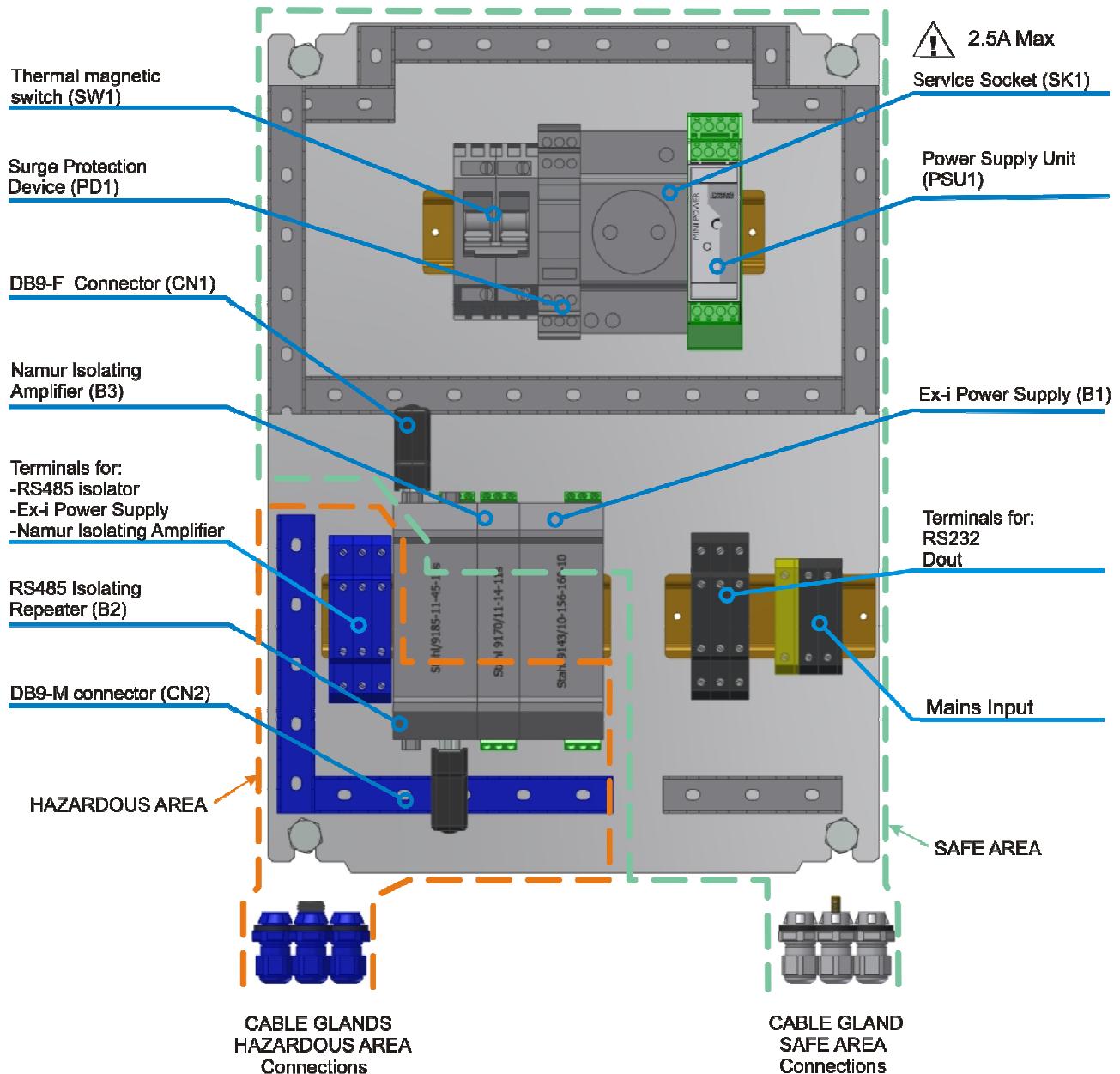


Fig. 5 – Internal layout and components ID for FIO RTU 115-230VAC

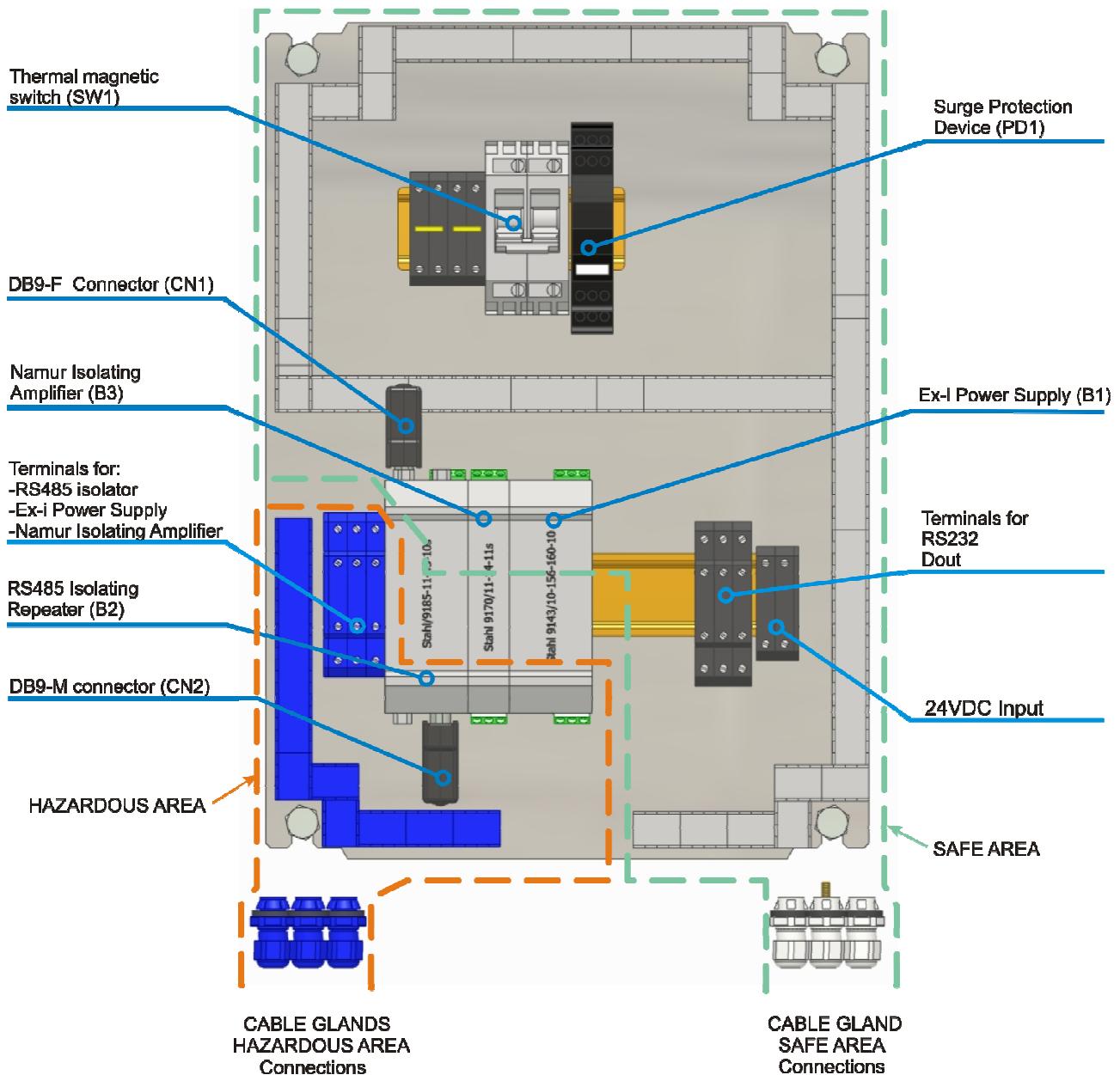


Fig. 6 – Internal layout and components ID for FIO RTU 24VDC

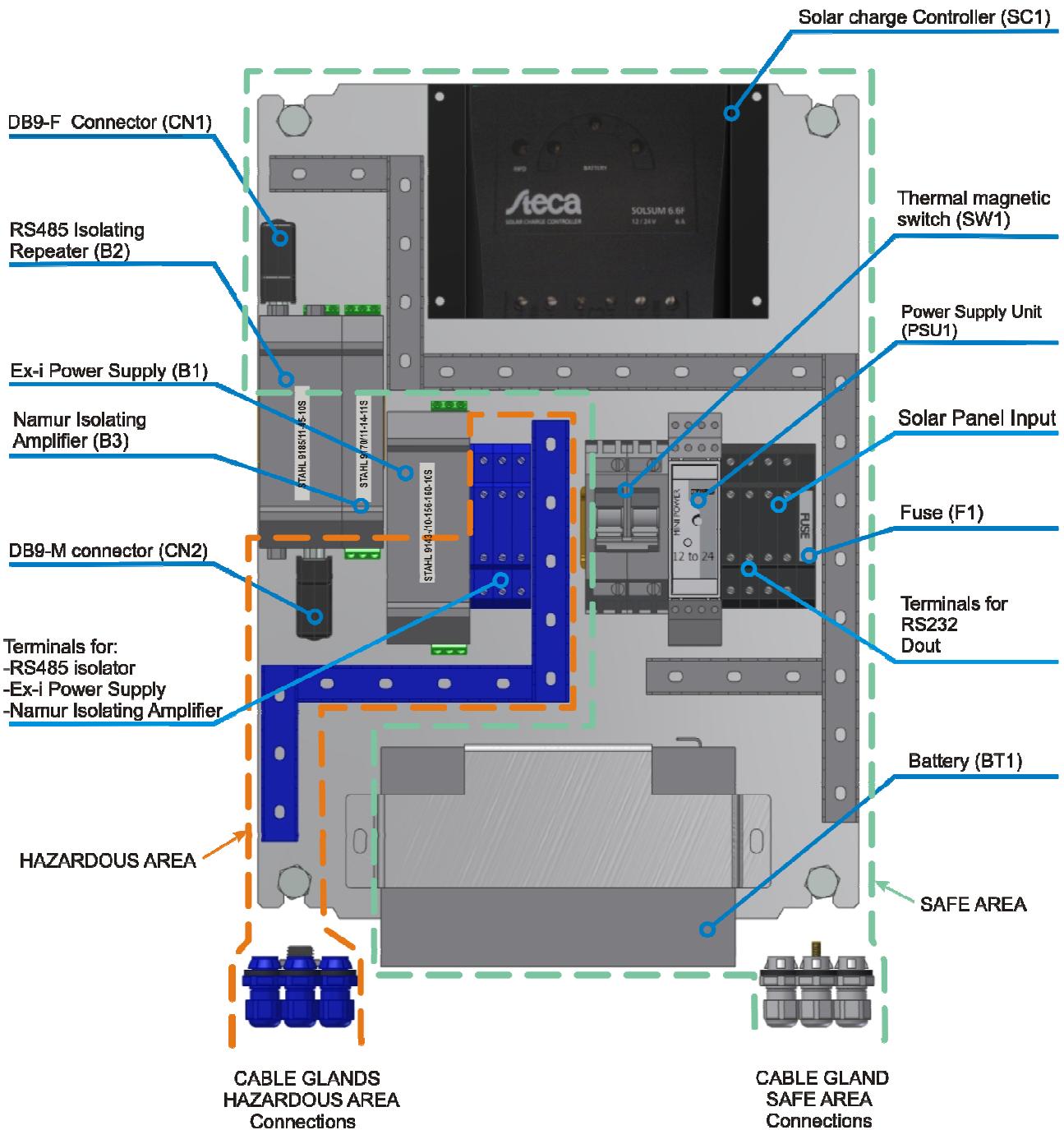


Fig. 7 – Internal layout and components ID for FIO SOLAR



## **3. Installation**

### **3.1 Mechanical**

FIO RTU e SOLAR cabinets can be installed on the wall or pole.

Wall mounting is accomplished by the supplied accessories (Legrand, 036409 code) which can be mounted on the back of the cabinet. Use grub screw anchors or screws depending on the installation wall.



Fig. 8 – Wall mounting support

The drawings with drilling dimensions are available on a separate document of the manufacturer of the cabinet attached to the product.

Pole mounting is accomplished via custom adapters to be fastened to the back of the cabinet by bolts



Fig. 9 – Pole mounting



### 3.1.1 Solar panel installation

20W Solar Panel is supplied with brackets for fixing to the pole with the structure shown in Fig. 7.



Fig. 10 – Solar panel mounting structure

The Panel must be secured using the screws included and orienting the longest side horizontally. Refer also to the instructions included in the Panel. The jaws on the rear side of the structure are used to fasten the structure to the pole.

#### 3.1.1.1 Panel orientation

The Panel should be oriented in such a way as to maximize exposure to sunlight within a year. Orient the Panel to South if installed in the northern hemisphere and to North when installed in the southern hemisphere. Tilt relative to the horizon of the angle indicated in table 1. Check that throughout the day the Panel is not in shadow areas.

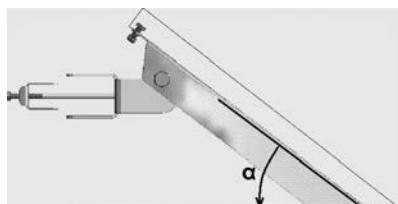


Fig. 11 – Panel orientation

Tilt angle	
Latitude (L)	Angle $\alpha$
0° - 15°	15°
15° - 25°	L
25° - 30°	L+5°
30° - 35°	L+10°
35° - 40°	L+15°
≥ 40°	L+20°

Tab. 1 – Tilt angle



## 3.2 Electrical installation

### 3.2.1 Terminal blocks

The terminal blocks are divided into two groups with colors Blue and gray, the cable glands are grey and blue also. The signal terminal blocks and the solar panel terminal blocks consist of two levels. The Jn in red identifies the terminal block ( see dwg below )

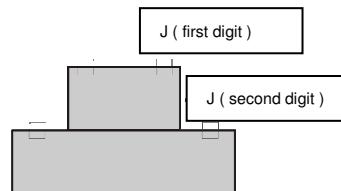


Fig. 12 – Two levels terminal block

The blue group identifies the intrinsically safe connections (IS) and is reserved for the connection to the FIO 2.0 gray group is to connect power and to connect the equipment to those in safe area (PLC, PC.)

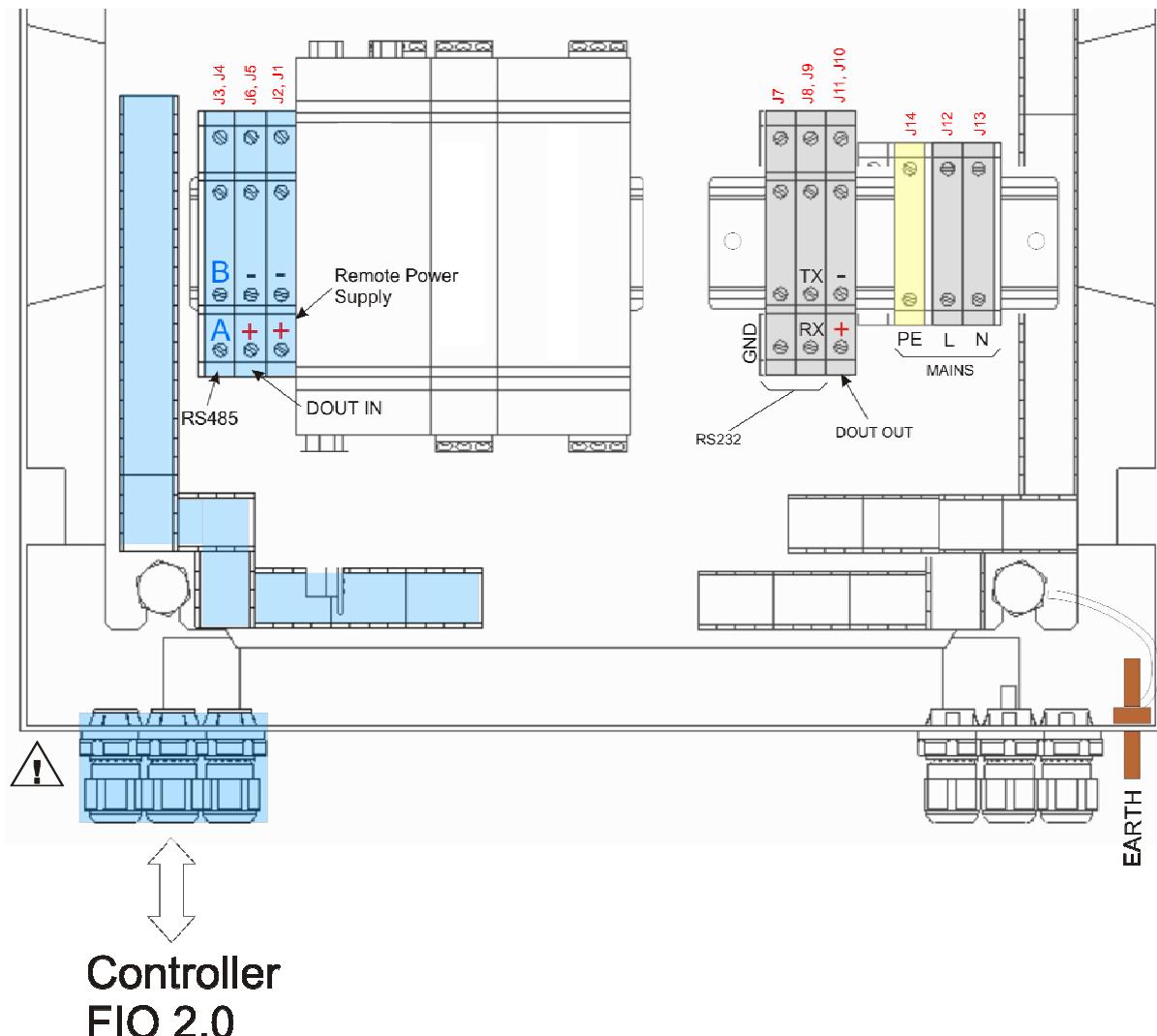


Fig. 13 – Connections for FIO RTU 115-230VAC

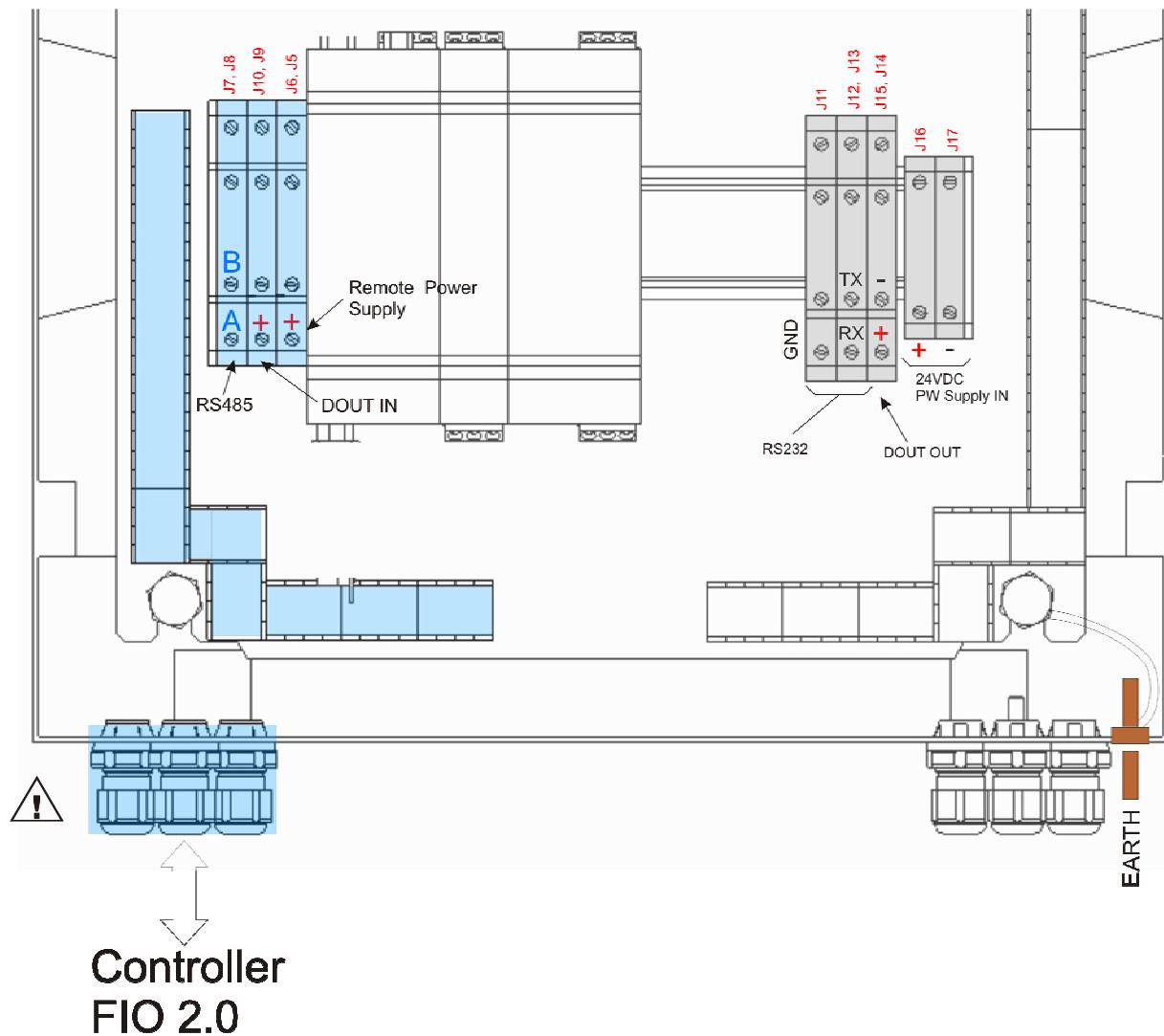
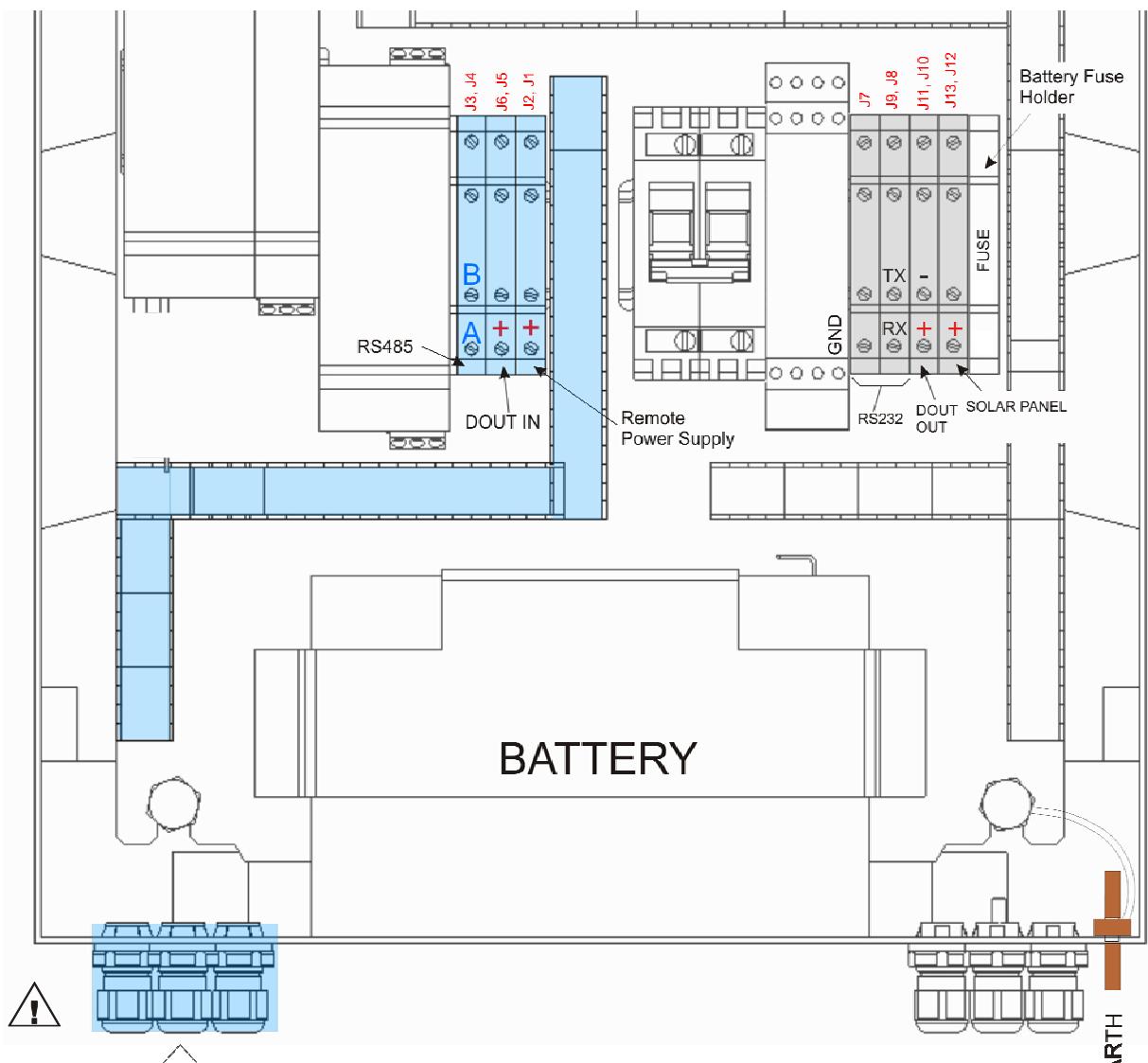


Fig. 14 – Connections for FIO RTU 24VDC



## Controller FIO 2.0

Fig. 15 – Connections for FIO SOLAR

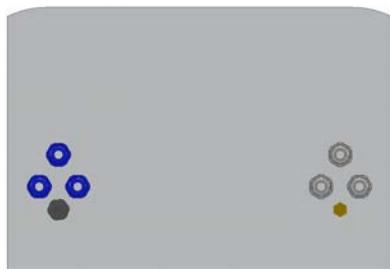
### 3.2.2 General information

- Keep separated the cable paths for the IS circuits (BLUE cable) from the NON-IS ones
- Use a single cable gland for each cable
- The cables must pass and be fixed in the respective blue and grey conduits





### 3.2.3 *Cable glands*



#### Grey cable glands

PWS connection  
Data connection to external apparatus  
Ground peg: ground connection

#### BLU cable glands

Connections to FIO2.0  
Gray cap: pressure equalizer

Fig. 16 – Cable glands

### 3.2.4 *Power supply*

 Connect the earth cable to the appropriate peg on the bottom  
Use unipolar cable Y/G 2.5 mm<sup>2</sup>

#### 3.2.4.1 *RTU 115-230V*

Make sure you have removed the power supply connection. Turn OFF the circuit breaker inside the FIO RTU. Connect the cables according to the Neutral- Line indications

 On this version there is a transparent Security Panel for the power terminals (not visible in drawings) restore the Panel immediately after making the connections

#### 3.2.4.2 *RTU 24VDC*

Make sure you have removed the power supply connection. Turn OFF the circuit breaker inside the FIO RTU. Connect the cables according to the "+" and "-" indications

#### 3.2.4.3 *RTU SOLAR*

Turn OFF the circuit breaker inside the FIO RTU.

Lift the battery fuse holder cap.

Insert the battery positive fast on type terminal

Connect the cable coming from the Solar Panel respecting the polarity

### 3.2.5 *Data connections*

#### Connections to FIO2.0

Use the shielded cable specified in the chapter "cables "

Connect to FIO2.0 using the following table and image

FIO2		FIO RTU / SOLAR		
Signal	Terminal	RTU 115-230VAC	RTU 24VDC	SOLAR
(EXT. PW SUPPLY)	M19.1	Positive	J1	J5
	M19.2	Negative	J2	J6
	M19.3	Shield	N.C.	N.C.
Digital signal (DOUT-N)	M12.1	Positive	J5	J5
	M12.2	Negative	J6	J6
	M12.3	Shield	N.C.	N.C.
RS485 (RSA)	M13.1	A+	J3	J3
	M13.2	B-	J4	J4
	M13.3	Shield	N.C.	N.C.

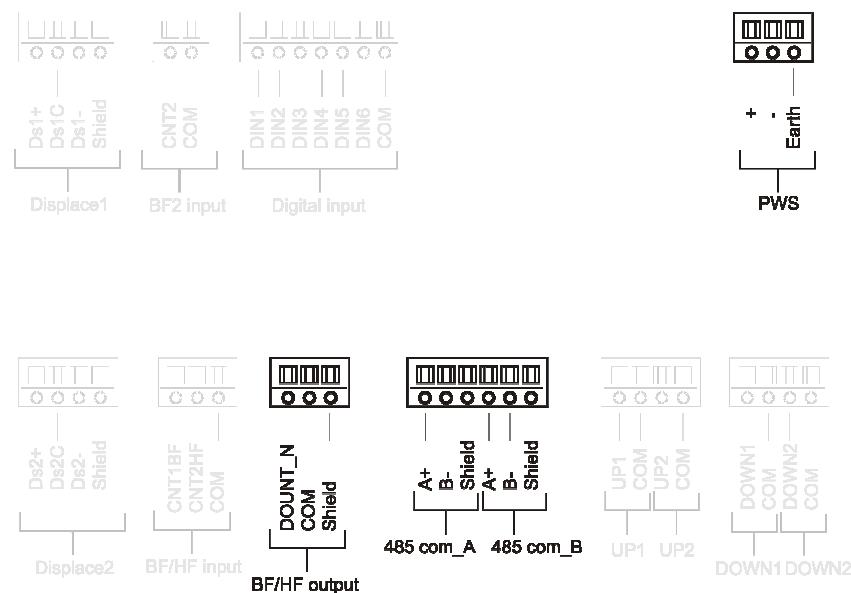


Fig. 17 – FIO2.0 – connections to FIO RTU apparatus

### Connections to apparatus in safe area

Use a shielded cable for data connection

External apparatus		FIO RTU / SOLAR		
Type	Signal	RTU 115-230VAC	RTU 24VDC	SOLAR
RS232 output	TXD	J9	J13	J9
	RXD	J8	J12	J8
	GND	J7	J11	J7
Digital output	+	J10	J14	J10
	-	J11	J15	J11

 Connect the shield on FIO2 side in the specified terminal  
Shield on FIO RTU / SOLAR side NOT CONNECTED

### 3.3 *Cables*

 The cables that connect 2.0 with FIO FIO RTU/SOLAR must meet some requirements for the installation in hazardous area.

Type	Shielded
Insulation	$\geq 600\text{VRms}$
Insulation thickness	$\geq 0.25\text{mm}$
Maximum temperature	$> +70^\circ\text{C}$
Inductance / Capacity	see § 3.3.2

The following cables are recommended

#### Data connections (RS485 and digital)

Manufacturer	Kabeltronik
Model	020202500
Conductors	2x0.25mm <sup>2</sup>
Capacity	120pf /m

### Alternative

Manufacturer	AlfaWire
Model	3231
Conductors	2 x 0.33mm <sup>2</sup>
Inductance	66nH/ m
Capacity	27pf / m



**Remote power supply connection**

Manufacturer	AlfaWire
Model	3231
Conductors	2 x 0.52mm <sup>2</sup>
Inductance	55nH/ m
Capacity	30pf /m

**3.3.1 Ex conformity**

All devices connected to the FIO 2.0 must be placed IN SAFE AREA and must be approved as Associated Devices, and must be compatible to the SECURITY PARAMETERS (IS). FIO RTU and SOLAR are compatible, however the evaluation should be taken into account also the connecting cable. In particular, it must be

Associated device parameter	CONDITION	FIO2.0 parameter
Uo	≤	Ui
Io	≤	li
Po	≤	Pi
Co	≥	Ci + cable capacity
Lo	≥	Li + cable inductance

*The condition must be respected even in the opposite direction where applicable*

Uo / Io / Po	maximum voltage / Current / Output power output from the associated device (RTU / SOLAR)
Ui / li / Pi	maximum voltage / Current / FIO2.0 Input power
Ci / Li	maximum Capacity / inductance present at the input terminals of the FIO 2.0
Co / Lo	maximum Capacity/ Applicable inductance to the associated device terminals (RTU/SOLAR)
C cable, L cable	maximum Capacity/ Cable inductance ( considering the length also )

**Pietro Fiorentini S.p.A declines any liability from risks and consequences arising from non-observance of these instructions.**

**3.3.2 Maximum cable length**

Taking into account the Ex restrictions, functional lengths allowed are

• RS485	1200m (max 56.7Kb/s)
• Digital IN	100m
• Remote power supply	100m

Functional	
RS232	15m
Digital	100m



The ground wire, and only that, should be yellow/green



## 3.4 Settings

Internal devices have some sliders and potentiometers. The apparatus comes with these presets.

### 3.4.1 Serial communication isolator settings

Model STAHL 9185  
Default settings 19200, 8, N, 1

Slider	Position	Min	Max
BAUD	5	1 (1200baud)	8 (57.6 Kbaud)
RS2.1 (SCAN)	OFF		
RS2.2	OFF		
RS3.1	OFF		
RS3.2	ON		

### 3.4.2 Remote power supply settings

Model STAHL 9143  
Default setting 12V



Do not change the preset value. Any adjustments must return the power to the preset value. The Indications are for reference only

Potentiometer	Position
Trimmer UA	set to minimum

### 3.4.3 Digital signal isolator settings

Model STAHL 9170  
Default setting LF1: OFF, INV1: OFF

Slider	Position ON	Position OFF
DIP 1	LF1	Line fault detection enabled
DIP 2	INV1	Inverts the output signal (NC)
DIP 3	not active	Do not Invert the output signal (NO)
DIP 4	not active	

### 3.4.4 24V Power supply settings

The power supplies in the RTU model 115-230VAC and Solar have a trimmer for adjusting the output voltage. Do not change the default 24V-0/1V.



## 4. Operation

### 4.1 Description

FIO RTU devices and SOLAR are the interface between the FIO 2.0 installed in hazardous area and the devices installed in the safe area.

#### Switch

All models are equipped with a circuit breaker. Move up the lever to switch on the apparatus.

#### Remote power supply

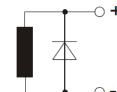
Provides power to the FIO 2.0 used only to recharge the lithium-ion rechargeable battery inside.

#### Signal repeating

Conversion interface and galvanic isolation between the RS485 serial A (or B) of FIO 2.0 and an external device with RS232 interface. Uses the TX and RX signals only.

#### Namur contact repeater

Conversion interface and galvanic isolator between the output Namur standard of the FIO2 and an external device. The interface is open drain type. If using inductive devices you must put a diode as indicated in figure below



### 4.2 Led signaling

Internal devices have some LEDs. See the layout to identify the device

#### 4.2.1 RS485/RS232 repeater/isolator

LED	Color	Function
PWR	Green	ON: Power present
ERR	Red	ON: short circuit RS232 or RS485 lines Flashing: baud rate auto tuning (not used)
RxD1	Green	Rx signal monitor RS 232 signal (from PC / PLC)
RxD2	Green	Not used
RxD3	Green	Rx signal monitor RS 485 signal (from FIO2.0)

#### 4.2.2 Switching repeater/isolator

LED	Color	Function
PWR	Green	ON: Power present
LF	Red	Line Fault: short circuit or non-compliant level of Namur signal
OUT1	Yellow	Output status= ON: active

#### 4.2.3 Remote PWS

LED	Color	Function
PWR	Green	ON: Power present

#### 4.2.4 Battery charger

Only for FIO Solar

LED	Color	Function
INFO	Two-colors (Green/Red)	Green: normal operation Red, flashing: overload, over temperature Red: low battery voltage Red+Green: battery voltage too high
BATT	Three-colors Red, Yellow, Green	Red flashing slowly: low voltage battery, load disconnected Red flashing quickly: low battery voltage, battery charging Yellow-green: battery level Green flashing quickly: battery full, stand-by function



**4.2.5 PWS- DC/DC converter 24V**

RTU 24VDC excluded

LED	Color	Function
PWR	Green	ON: Power present



## 5. Technical data

### 5.1 General

Parameter	Technical data
Cabinet type	Cabinet with opening door
Material	Polyester reinforced with glass fiber
Dimensions	400x300x200mm (cable glands excluded)
Weight	RTU 7.5Kg SOLAR 11Kg
Degree of protection	IP65
Operating temperature	-20°C / +60°C
Storage temperature	-30°C / +70°C
Relative humidity	≤ 50% a +40°C non condensing
Max operating altitude	≤ 2000m
Connection	DIN mounted terminal blocks max 6mm <sup>2</sup> / ground connection = threaded M4
Cable glands	PG11

### 5.2 Power supply

Parameter	Technical data
<b>RTU</b>	
Model RTU 115-230VAC	100–240VAC, 50-60Hz, 3.15A
Model RTU 24VDC	20V–30V, 0.6A
Protections	Magneto-Thermal Switch/Surge Protector
Service socket (only for RTU 115-230VAC)	Schuko 2.5A max
In/Out isolation	3KVAC

### SOLAR

Solar panel rating	Max 40W, open circuit voltage 45V max, battery charging current 3A max	
Standard panel	Kyocera KC21 (21W) or equivalent	
Battery	YUASA NP12-12 (12V / 12Ah)	
Autonomy	All the functions Remote PWS+ Digital isolator Remote PWS+ Serial isolator	≥ 18 h ≥ 24 h ≥ 20 h
100% Recharging time	≤ 10 h (Standard panel, insolation 100%)	
Protections	Magneto-Thermal Switch/ Battery fuse (5x20mm 10A - 1500A)	
Insulation (DC/DC converter)	1.5KVAC	



## 5.3 Functional

Function	Parameter	Technical data
Switching Repeater	Bandwidth	0Hz - 10KHz
	Input	Standard Namur (polarization 8.2V)
	Output	Open Drain 30VDC, 5mA max
	Insulation	300VAC
Fieldbus Isolating Repeater	Standard Input	RS485 , 2 wires
	Standard output	RS232 , 2 wires
	Max baud rate	38.4Kbaud
	Insulation in/out	1.5KVAC
FIO output PWS (Ex i Power Supply)	Voltage	12V
	Current	160mA
	Insulation in/out	1.5KVAC

## 5.4 Normative compliance

Type	Norma Description
Electrical safety	EN-60950-1 IEC-60950-1 Information technology equipment - Safety - Part 1: General requirements
EMC	EN 61326-1 Electrical equipment for measurement, control and laboratory use EMC requirements - Part 1: General requirements EN 61000-6-3 (General requirements - Emission for residential environments, commercial light industrial) EN 61000-6-2 (Generic standards-immunity for industrial environments)
Intrinsic safety	EN 60079-0: 2012 EN 60079-11: 2012 IEC 60079-0: 2011 IEC 60079-11: 2011



## **6. Maintenance**

No maintenance operations are envisioned except for battery replacement

### **6.1 Battery**

#### **6.1.1 Battery life**

Replace the battery with annual periodicity.

If the place of installation has an average high temperature, replace the battery every 6 months.

#### **6.1.2 Battery replacement**

Follow this procedure

- Switch off the apparatus
- Open the fuse holder and remove the fuse
- Disconnect the cables from the battery
- Remove the fixing screws of the support frame
- Remove the battery
- Insert the new battery and fix it
- Reconnect the cables



Dispose of spent batteries using the special containers

#### **6.1.3 Fuse**

The fuse should never intervene.

In case of intervention replaced with the same model

Type	5x20mm ceramic
$I_N$	10A Retarded
Voltage	250VAC
Breaking Power	1500A

If after the replacement occurs a new intervention, disconnect the battery switch off the appliance and do not use it.